

EXECUTIVE SUMMARY

The U.S. Department of Energy's (DOE's) Waste Isolation Pilot Plant (WIPP) opened on March 26, 1999, becoming the nation's first deep geologic repository for the permanent disposal of defense-generated transuranic (TRU) waste. DOE TRU waste generation has occurred at 27 sites across the country – six large-quantity and 21 small-quantity sites. Six of these sites have emplaced their waste at WIPP, found other disposition pathways for the waste, or have transferred the waste to other sites for further disposition. The remaining TRU waste is currently retrievably stored at 21 sites, six of which are potential TRU waste sites (see Figure 1, section 1.1). From the WIPP's opening through the inventory date (December 31, 2006), 5,347 shipments of TRU waste were safely characterized, transported, and emplaced in the WIPP (Moody 2007a).

Since 1994, DOE complex-wide TRU waste inventory information has been collected, analyzed, and published for WIPP certification purposes in several reports. The *WIPP Transuranic Waste Baseline Inventory Report* (WTWBIR), Revision 0, published in June 1994 (DOE 1994), was the first attempt made by the DOE complex to report all of its TRU waste at the waste-stream level. The TRU waste data reported in Revision 0 were considered preliminary until the DOE TRU waste sites completed quality checks of the data. Data changes resulting from the quality checks were contained in the WTWBIR, Revision 1 (DOE 1995a). The *Transuranic Waste Baseline Inventory Report* (TWBIR), Revisions 2 and 3 (DOE 1995b and DOE 1996a), included WIPP and non-WIPP (potential TRU waste) waste streams, along with waste stream characteristic information. Data from Revisions 2 and 3 provided the TRU waste inventory that Sandia National Laboratories–Carlsbad Programs Group (SNL-CPG) used to perform the necessary modeling calculations for the performance assessment (PA) for the initial certification of the WIPP (*Compliance Certification Application* [CCA]) (DOE 1996b).

Certification/Recertification	Inventory Report Used
CCA	TWBIR, Revisions 2 and 3
CRA-2004	Appendix DATA, Attachment F
PABC	TWBIR-2004
CRA-2009	TWBIR-2004

Knowing that TRU waste inventory information is subject to change as a result of characterization activities, improved estimation processes, emplacement of waste in the WIPP, and ongoing generation activities, the U. S. Environmental Protection Agency (EPA) requested that an update to the CCA inventory be included in the WIPP *Compliance Recertification Application 2004* (CRA-2004) (DOE 2004). In response to this request, the TRU waste inventory update was provided with summary data and supplemental information required for the CRA-2004 and was published as Appendix DATA, Attachment F of the CRA-2004.

The primary purpose of the *Transuranic Waste Baseline Inventory Report - 2004* (TWBIR-2004) (DOE 2006c), which was a revision of Appendix DATA, Attachment F

of the CRA-2004, was to support the Performance Assessment Baseline Calculation (PABC) for the CRA-2004. The TWBIR-2004 provided the summary data required for the PA modeling calculations that were used in the PABC (Leigh et al. 2005a; Leigh et al. 2005b), including two inventory changes at Idaho National Laboratory (INL) and Hanford that occurred during the EPA's review of the CRA-2004. Beginning with the *Annual Transuranic Waste Inventory Report – 2007* (hereafter referred to as “this report”), site inventory information will be updated annually to track changes in the TRU waste inventory.

The WIPP Land Withdrawal Act (LWA) requires EPA to periodically recertify WIPP's compliance with regulations published at Title 40 Code of Federal Regulations, Part 191 (40 CFR 191), in accordance with criteria established at 40 CFR Part 194.¹ Under the LWA, five years after the initial receipt of TRU waste at WIPP and every five years thereafter, DOE must submit an application to EPA documenting continued compliance, and EPA must determine (i.e., recertify) that WIPP continues to comply with those regulations within six months of each application submission. DOE submitted the first recertification application, CRA-2004 (DOE 2004), to EPA in March 2004, and EPA recertified WIPP in March 2006.

The CRA-2004 included TRU waste inventory data documented in the TWBIR-2004. This report provides updated information to the TWBIR-2004. The information gathered for this report was entered into the Comprehensive Inventory Database [CID] Version 1.00 Schema Version 1.00, Data Version D.6.06 (hereafter referred to as CID Data Version D.6.06) (LANL-CO 2008). The CID is a DOE Carlsbad Field Office (CBFO) database qualified by the CBFO *Quality Assurance Program Document* (QAPD) (DOE 2007). The CID includes estimates for: 1) waste volumes (stored, projected, and emplaced); 2) radionuclides (scaled, unscaled, and decayed); 3) waste material parameters; 4) complexing agents; 5) oxyanions; 6) solidified cements; 7) packaging materials; and 8) the materials used to emplace TRU waste in the WIPP.

This revision is the result of the discovery of a calculation error based on the methodology by Los Alamos National Laboratory (LANL) to report radionuclide activity concentration for their waste streams. The site provided their methodology for determination of radionuclide activity concentration based on the concentration within the smallest applicable volume of a container in the waste stream. As an example, if Pu-238 was disposed in 1-gallon paint cans, the concentration (in Ci/m³) was calculated by summing the activity for Pu-238 and dividing by the volume of the 1-gallon paint cans. This resulted in an inordinately high activity concentration for the contact-handled (CH) and remote-handled (RH) waste streams because the same methodology was applied to all LANL waste streams. Therefore, LANL recalculated activity concentrations for all of their waste streams based on the final form volume of the entire waste stream.

¹See Pub. L. No. 102-579, § 8, 106 Stat. 4777, 4786-4788 (U.S. Congress 1992), as amended, Waste Isolation Pilot Plant Land Withdrawal Act Amendments, Pub. L. No. 104-201, § 3187, 110 Stat. 2422, 2852 (U.S. Congress 1996).

The following primary differences were observed at the TRU waste sites between previous inventory data submittals (TWBIR, Revisions 2 and 3, and TWBIR-2004) and this report:

- Paducah's Gaseous Diffusion Plant TRU waste was re-categorized from WIPP-bound to potential, since a waste processing method has not been determined.
- Classified waste at all DOE TRU waste sites was categorized as potential TRU waste, since proper sanitization has not been completed.
- Hanford Richland (RL) has categorized some of its 618-10 and 618-11 buried waste as potential TRU waste.
- Hanford RL K-Basin knock-out pot sludge has been re-categorized as potential TRU waste.
- Hanford Office of River Protection (RP) tank waste has been re-categorized as potential TRU waste.
- The two INL sodium-bearing waste streams have been re-categorized as potential TRU waste.
- Some small quantity sites were removed from the TRU waste inventory because they have been de-inventoried of TRU waste.
- Rocky Flats Environmental Technology Site has emplaced all of its TRU waste in the WIPP.
- TRU waste emplaced between the 1999 opening of the WIPP and December 31, 2006 (the inventory data cut-off date), was addressed.

Since the TWBIR-2004 was prepared, a number of significant developments have occurred that changed the volume, physical characteristics, or radiological characteristics of TRU waste streams as they were reported by the sites for the 2006 inventory. These developments include:

- Regulations and decisions at the federal and state level. For example, INL has begun preparations to ship pre-1970 buried waste to the WIPP, as mandated by a federal court decision (Wasden 2003). Shipment of pre-1970 buried waste has increased the volume of stored waste at INL because this type of waste is generally not planned for disposal at the WIPP.
- Waste program management decisions. All waste streams from the Hanford RP and two sodium-bearing waste streams from INL have been re-categorized as potential WIPP waste pending finalization of the DOE's TRU waste determination process. This change significantly reduced the volume of stored RH-TRU waste in the 2006 inventory;
- Availability and confidence in supplemental characterization information or process knowledge. For example, waste streams stored at LANL have a

significant increase in curies in the 2006 inventory because of improvements in LANL's methodology for tracking and characterizing TRU waste.

- Site estimates of projected TRU waste stream volumes. Changes in projected waste streams directly affect the CH and RH scaling factors that determine the disposal inventory for PA.
- Continuing waste emplacement at WIPP. As of December 31, 2006, 44,687 cubic meters (m^3) of waste have been emplaced in the WIPP, reducing the volume of stored waste at the sites by an equal amount.
- Methodology enhancements. The 2006 inventory incorporates standardized masses for packaging material for each type of waste container (Crawford 2007). This approach provides a consistent and conservative representation of packaging materials over all waste streams. This approach has increased the masses of cellulose and plastics in the 2006 inventory.
- Enhanced Data Checks. Several data checks were performed on the data collected from the sites to ensure all radionuclides were reported where, for example, a few mixed fission products were typically reported and radionuclides in secular equilibrium were reported. The results of these checks were discussed with the TRU waste sites and data were changed, as necessary, under the sites' direction. In addition to radionuclides, where cement was reported in comment fields, cement data were checked to ensure cement was also included as a waste material parameter.

This report includes updates to the site TRU Waste Baseline Inventory Waste Profiles (hereafter referred to as "waste profiles") that were reported in the TWBIR-2004. The waste profiles reflect the data as reported by the DOE TRU waste sites. This report includes WIPP-bound waste, emplaced waste, potential TRU waste, inventory comparisons, radiological data, and a historic crosswalk of TRU waste streams in Appendices A, B, C, D, E, and F, respectively.

The information contained in the CID is the best estimate of TRU waste inventory information as of December 31, 2006, and includes the changes requested by CBFO on October 18, 2007, and subsequent updates to LANL, Savannah River Site (SRS), and WIPP Waste Information System (WWIS) emplaced radiological concentrations delineated throughout this revision. This report includes reports generated from the CID, as well as TRU waste characterization data acquired since September 30, 2002 (the TWBIR-2004 inventory data cut-off date), obtained from the WWIS.

In addition, the radionuclides have been decayed to several dates for use in PA modeling calculations (see Appendix E). References to the methodologies used to decay the radionuclides are provided in the documentation of Oak Ridge National Laboratory (ORNL) Radiation Safety Information Computational Center (RSICC) *Computer Code Collection: ORIGEN 2.2, Isotope Generation and Depletion Code Matrix Exponential Method* (ORNL 2002).

Part of the purpose of issuing this report is to provide CBFO with an up-to-date tool for planning purposes. Specifically, CBFO management will use TRU waste inventory information to plan waste retrieval, treatment, repackaging, characterization, shipment, and disposal for both stored and projected wastes. Site-specific work plans that detail approaches for moving TRU waste to the WIPP are developed and are continually updated using TRU waste inventory information. Other technical uses for the TRU waste inventory include information for activities in support of National Environmental Policy Act (NEPA) analyses and the development of new containers or shipping packages.

To support the CRA-2009 submittal to EPA, the *Annual Transuranic Inventory Report – 2008* (ATWIR 2008) will be used to support PABC-2. ATWIR-2008 will include TRU waste inventory information through December 31, 2007, and will be delivered to CBFO on October 1, 2008. If EPA requires an updated inventory during its completeness review of CRA-2009, the PABC-2 inventory will use this inventory information.

The following tables summarize the main body of the text of this report:

- Table ES-1. WIPP CH-TRU Waste Material Parameter Inventory
- Table ES-2. WIPP RH-TRU Waste Material Parameter Inventory
- Table ES-3. WIPP CH-TRU Waste Inventory by Site
- Table ES-4. WIPP RH-TRU Waste Inventory by Site
- Table ES-5. WIPP CH-TRU Disposal Radionuclide Inventory Summary
- Table ES-6. WIPP RH-TRU Disposal Radionuclide Inventory Summary

Table ES-1. WIPP CH-TRU Waste Material Parameter Inventory

Waste Material	Average Density (kg/m³)
Iron-based Metals/Alloys	1.8E+02
Aluminum-based Metals/Alloys	1.5E+01
Other Metal/Alloys	1.1E+01
Other Inorganic Materials	3.4E+01
Cellulosics	7.3E+01
Rubber	6.6E+00
Plastics	8.2E+01
Cements	6.8E+01
Solidified Inorganic Material	1.1E+02
Solidified Organic Material	4.6E+01
Soils/gravel	9.1E+00
Vitrified	0.0E+00
Package Material	
Packaging Material, Steel	1.8E+02
Packaging Material, Plastic	1.9E+01
Packaging Material, Cellulosics	4.7E+00
Packaging Material, Lead	0.0E+00

Data Source: CID Data Version D.6.06, LANL-CO 2008.

NOTE: Actual numerical values have been rounded for presentation purposes.

Table ES-2. WIPP RH-TRU Waste Material Parameter Inventory

Waste Material	Average Density (kg/m³)
Iron-based Metals/Alloys	1.9E+02
Aluminum-based Metals/Alloys	1.0E+01
Other Metal/Alloys	4.5E+01
Other Inorganic Materials	2.3E+01
Cellulosics	1.4E+01
Rubber	4.7E+00
Plastics	1.8E+01
Cements	1.2E+01
Solidified Inorganic Material	5.9E+02
Solidified Organic Material	7.1E-01
Soils/gravel	7.7E+01
Vitrified	7.2E-02
Package Material	
Packaging Material, Steel	6.1E+02
Packaging Material, Plastic	1.1E+01
Packaging Material, Cellulosics	0.0E+00
Packaging Material, Lead	5.4E+00

Data Source: CID Data Version D.6.06, LANL-CO 2008.

NOTE: Actual numerical values have been rounded for presentation purposes.

Table ES-3. WIPP CH-TRU Waste Inventory by Site

Storage/Generator Site	Stored Volumes (m ³)	Projected Volumes (m ³)	Anticipated Volumes (m ³)	Emplaced Volumes (m ³)
Argonne National Laboratory – East	8.3E+00	7.9E+01	8.8E+01	1.2E+02
Argonne National Laboratory – West (MFC)	7.5E+00	3.0E+01	3.7E+01	0.0E+00
Bettis Atomic Power Laboratory	1.9E+01	0.0E+00	1.9E+01	0.0E+00
Hanford (Richland) Site	1.4E+04	0.0E+00	1.4E+04	2.6E+03
Idaho National Laboratory	5.9E+04	0.0E+00	5.9E+04	1.6E+04
Knolls Atomic Power Laboratory - Nuclear Fuel Services	2.1E+00	1.2E+02	1.3E+02	0.0E+00
Lawrence Berkeley Laboratory	2.1E-01	2.1E-01	4.2E-01	0.0E+00
Lawrence Livermore National Laboratory	2.9E+02	9.1E+01	3.8E+02	1.4E+02
Los Alamos National Laboratory	1.5E+04	1.1E+03	1.6E+04	1.5E+03
Nevada Test Site	3.0E+02	3.7E+02	6.7E+02	4.0E+02
Oak Ridge National Laboratory	6.8E+02	3.4E+02	1.0E+03	0.0E+00
Rocky Flats Environmental Technology Site	0.0E+00	0.0E+00	0.0E+00	1.5E+04
Sandia National Laboratories - Albuquerque	2.5E+01	4.4E+00	2.9E+01	0.0E+00
Savannah River Site	1.0E+04	8.4E+02	1.1E+04	9.6E+03
U.S. Army Material Command	2.1E-01	0.0E+00	2.1E-01	0.0E+00
Grand Total	1.0E+05	3.0E+03	1.0E+05	4.6E+04

Data Source: CID Data Version D.6.06, LANL-CO 2008.

NOTE: Actual numerical values have been rounded for presentation purposes.

This table contains data for WIPP-bound waste streams reported by site only; it does not include data for potential waste streams.

Table ES-4. WIPP RH-TRU Waste Inventory by Site

Storage/Generator Site	Stored Volumes (m ³)	Projected Volumes (m ³)	Anticipated Volumes (m ³)	Emplaced Volumes (m ³)
Argonne National Laboratory - East	1.1E+01	3.2E+01	4.3E+01	0.0E+00
Argonne National Laboratory – West (MFC)	6.2E+00	3.5E+01	4.1E+01	0.0E+00
Bettis Atomic Power Laboratory	3.6E+00	0.0E+00	3.6E+00	0.0E+00
Hanford (Richland) Site	1.2E+03	1.3E+02	1.3E+03	0.0E+00
Idaho National Laboratory	3.7E+02	0.0E+00	3.7E+02	0.0E+00
Knolls Atomic Power Laboratory – Schenectady	3.0E+01	8.0E+01	1.1E+02	0.0E+00
Los Alamos National Laboratory	9.8E+01	0.0E+00	9.8E+01	0.0E+00
Oak Ridge National Laboratory	9.3E+02	3.6E+02	1.3E+03	0.0E+00
Sandia National Laboratories - Albuquerque	2.0E+01	0.0E+00	2.0E+01	0.0E+00
Savannah River Site	4.2E+01	3.6E+01	7.8E+01	0.0E+00
Grand Total	2.7E+03	6.7E+02	3.3E+03	0.0E+00

Data Source: CID Data Version D.6.06, LANL-CO 2008.

NOTE: Actual numerical values have been rounded for presentation purposes.

This table contains data for WIPP-bound waste streams reported by site only; it does not include data for potential waste streams.

Table ES-5. WIPP CH-TRU Disposal Radionuclide Inventory Summary¹

Nuclide	CH-TRU Waste (Ci/m³)²
Am-241	2.76E+00
Ba-137m	4.50E-02
Cm-244	4.53E-02
Cs-137	4.84E-02
Eu-154	1.91E+00
Eu-155	1.29E+01
Pu-238	1.26E+01
Pu-239	3.19E+00
Pu-240	7.79E-01
Pu-241	1.13E+01

Data Source: CID Data Version D.6.06, LANL-CO 2008.

¹ Summary shows the ten CH radionuclides with the highest concentration decayed through December 31, 2006.

² Concentration based on 168,485 m³ of CH waste.

Table ES-6. WIPP RH-TRU Disposal Radionuclide Inventory Summary¹

Nuclide	RH-TRU Waste (Ci/m³)²
Am-241	3.94E+00
Ba-137m	5.26E+01
Cm-244	1.23E+00
Cs-137	4.79E+02
Eu-152	3.20E+00
Pu-238	1.32E+00
Pu-239	1.10E+00
Pu-241	3.23E+01
Sr-90	3.78E+02
Y-90	7.84E+01

Data Source: CID Data Version D.6.06, LANL-CO 2008.

¹ Summary shows the ten RH radionuclides with the highest concentration decayed through December 31, 2006.

² Concentration based on 7,079 m³ of RH waste.